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ORIGINAL STUDY

Computerized tomographic evaluation of the sella turcica: variations by gender and age

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ABSTRACT

OBJECTIVES. To evaluate measurements of sella turcica on computerized tomography (CT) scans.

MATERIAL AND METHODS. Using CT images of 185 subjects (122 male, 63 female), sella length (SL), posterior clinoid height (PCH), tuberculum sella (TS), sella height anterior (SA), sella middle height (SM), sella height posterior (SP), and sella anterior-posterior dimension (SAP), sella types (oval, circular and flattened) were measured in age groups (< 26, 26–40, 41–60, and > 60 y).

RESULTS. In the 41-60y group, the SL and SAP dimensions of the males (n=39) and SM, TS and PCH of the females (n=17) were longer than in the younger group [for males, 26-40y (n=32) and < 26y (n=38) groups; for females, 26-40y (n=19) and < 26y (n=19) groups]. In both males and females, mainly the circular type sella was observed (64.8% and 74.6%, respectively). The SL and SAP distance of the flat sella (n=46) was significantly longer, and the PCH, TS, SA and SM measurements of the flat sella were significantly shorter than those of the oval (n=13) and circular types (n=126).

CONCLUSION. The development of sella turcica continues through the age of 41 to 60 years. In the male group, growth was detected mainly in the anterior-posterior direction. The reason for this may be related to the decrease in the pars anterior of the pituitary gland and the enlargement of the pars posterior of the pituitary gland. However, in females, growth was detected mainly in the vertical direction. This is thought to be due to pituitary stalk elongation.

KEYWORDS: sella turcica, development, sella length, posterior clinoid height, tuberculum sella.

INTRODUCTION

The hypophysis cerebri, or the pituitary gland, is a complex neuroendocrine organ involved in the control of a variety of homeostatic mechanisms[1]. The pituitary gland is housed in the sella turcica near numerous vital structures, including the optic chiasma, the sphenoid sinus, the cavernous sinus, and the hypothalamus[2] and has vital endocrinologic functions. Many potential lesions may affect the pituitary gland, including inflammatory processes (adenohypophysitis and infections), tumors (adenomas, Rathke cleft cysts, and craniopharyngiomas), and vascular lesions (apoplexy and infarction)[1].

The development of the sella turcica is closely related to that of the pituitary gland, which must be completed before the sella turcica is formed. Changes in the development of the pituitary gland may secondarily lead to a deviation in the morphology of the sella turcica[3]. During embryological development, the sella turcica area is the key point for the migration of the neural crest cells to the frontonasal and maxillary developmental fields. The neural crest cells are involved in the formation and development of sella tur-

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cica and teeth[4].

The sellar and parasellar regions may be affected by a variety of diseases. In this region, measurements may be done by computerized tomography (CT) or magnetic resonance (MR) images[5].

In the present study, we aimed to evaluate measurements on sella turcica using CT scans and we investigated the differences by gender and age.

MATERIAL AND METHODS

This retrospective study was conducted between June 2015 and September 2015, at the Kırıkkale University, Faculty of Medicine, according to the principles of the Declaration of Helsinki. CT scan images were obtained from the archive of the Kırıkkale University, Faculty of Medicine, Radiodiagnostic Department. The approval from the Local Ethics Committee of the Kırıkkale University Faculty of Medicine was taken (Date:27.10.2015, No: 2015-23-02).

Subjects

This study included cranial CT images of 185 subjects (122 male, 63 female), between 16 and 88 years old, randomly selected from a digital radiology database of all paranasal sinus images from the Kırıkkale University, Faculty of Medicine, Radiodiagnostic Department. The median age of the males was 35.0 ± 1.70 years, and the median age of the females was 37.0 ± 1.78 years.

Inclusion criteria:

- patients between 16 and 90 years old,
- patients with no chronic diseases.

Exclusion criteria:

- patients with cranio-facial fractures,
- patients with endocrinological problems,
- patients with osseous pathologies,
- patients with previous trauma or surgery history, such as pituitary tumor, sinonasal tumor, sinonasal polyposis, cerebrospinal fluid (CSF) leak, or marked facial deformities.

Technical Considerations of Multidetector Computed Tomography (MDCT)

All the scans were obtained with routine temporal bone imaging in the supine position, with no contrast or sedation used for the procedures. The images were acquired using a 64-slice CT (MSCT; Brilliance 64, Philips Medical System, Best, The Netherlands). All the scans were obtained using the following parameters: tube voltage = 120 kV, effective mAs = 350, slice thickness = 0.67 mm, field of view (FOV) = 180 mm, and image matrix = 768 x 768. The images were transferred to a commercially available workstation, and the raw data was reconstructed using bone algorithms (Philips Workstation Computer Programme). After scanning, the coronal and sagittal images were reconstructed.

The following measurements were performed:

1. Sella length (SL) (mm): The horizontal distance between the tuberculum sella (TS) and the posterior clinoid process.
2. Posterior clinoid height (PCH) (mm): The vertical distance of the posterior clinoid, as measured perpendicularly, from the posterior clinoid to the sella floor.
3. Tuberculum sella (TS) (mm): The vertical distance of the tuberculum sella, as measured perpendicularly to the *Frankfort horizontal* (*FH*) plane, from TS to the sella floor.
4. Sella height anterior (SA) (mm): The vertical distance, as measured perpendicularly to the FH plane, from the most anterior protruded part of the sella to the sella floor[6].
5. Sella middle height (SM): The vertical distance, as measured perpendicularly to the FH plane, from the sella floor to a midway point between the posterior clinoid (PClin) and TS[6].
6. Sella height posterior (SP) (mm): The vertical distance, as measured perpendicularly to the FH plane, from the most posterior protruded part of the sella to the sella floor[6].
7. Sella anterior-posterior dimension (SAP) (mm): The distance from the most anterior protruded part of the sella to the most posterior protruded part of the sella (Figure 1).

Measurements were performed in males and females of different age groups [<26 (n=57, 38 males and 19 females), 26-40 (n=51, 32 males and 19 females), 41-60 (n=56, 39 males and 17 females), and >60 y (n=21, 13 males and 8 females)] and with different sella types (oval, circular and flattened)[7] (Figure 1).

Statistical Analysis

SPSS for Windows 16.0 (SPSS, INC, an IBM Company, Chicago, Illinois) was used. A chi-square test, Mann-Whitney U test, Kruskal-Wallis Variance Analysis test, Mann-Whitney U test with Bonferroni adjustment, and Spearman's correlation rho efficient test were used. A p-value < 0.05 was considered statistically significant.

RESULTS

There was no statistically significant difference between the ages of the males and females ($p > 0.05$) (Table 1).

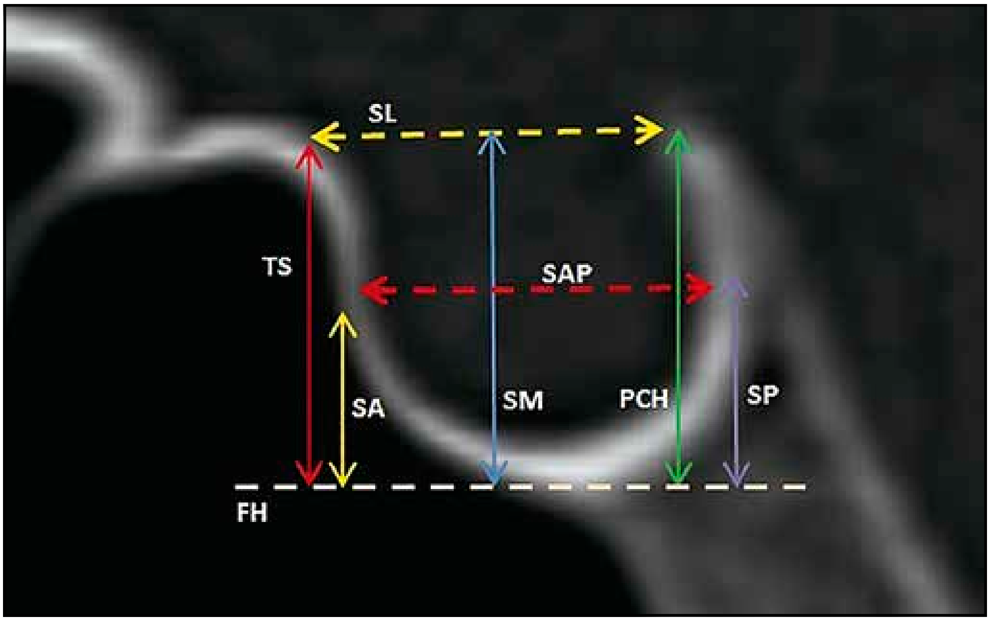

Figure 1. Sagittal Cranial Computerized Tomography. Oval sella turcica was demonstrated. SL: Sella length, PCH: Posterior clinoid height, TS: Tuberculum sella, SA: Sella height anterior, SM: Sella middle height, SP: Sella height posterior, SAP: Sella anterior-posterior dimension.

Measurement results for sella tursica in terms of SL, PCH, TS, SA, SM, SP and SAP are shown in Table 1 and Figure 2. There was no significant difference between the sella measurement results of the males and the females ($p > 0.05$) (Table 1).

Male and female sella measurement values in different age groups (< 26, 26–40, 41–60, and > 60 years (y)) are shown in Table 2 and Figure 3. The

Table 1. Measurement results for sella turcica.

	Males (n=122)					Females (n=63)					P*
	Mean	Median	Std. Dev.	Min	Max	Mean	Median	Std. Dev.	Min	Max	
Age	38.66	35.00	1.70	16.00	85.00	39.12	37.00	1.78	16.00	88.00	0.933
Measurements											
SL	9.83	9.70	2.11	4.20	23.20	9.56	9.20	1.74	5.90	13.50	0.331
PCH	9.15	9.05	2.67	1.10	26.10	9.17	9.20	2.31	4.20	18.20	0.888
TS	8.28	8.10	2.45	4.60	27.80	8.12	7.90	1.79	3.10	15.20	0.707
SA	4.09	3.75	1.91	1.80	14.40	3.85	3.60	1.39	2.20	8.80	0.657
SM	8.68	8.70	2.31	5.00	27.20	8.63	8.30	1.91	3.40	16.80	0.836
SP	4.05	3.90	1.39	1.40	11.20	3.96	3.90	1.41	1.70	8.40	0.748
SAP	10.93	10.85	2.24	5.40	26.80	11.27	11.30	2.09	7.50	22.10	0.216

*p value shows the results of Mann Whitney U test
SL: Sella length, PCH: Posterior clinoid height, TS: Tuberculum sella, SA: Sella height anterior, SM: Sella middle height, SP: Sella height posterior, SAP: Sella anterior-posterior dimension.

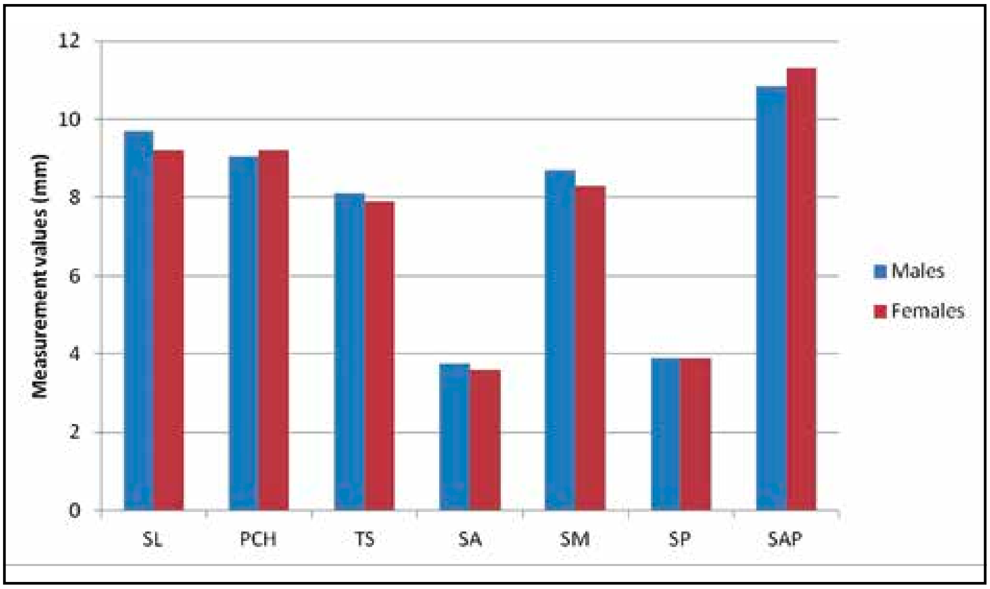

Figure 2. Sella measurement values of the males and females.

difference in each of the sella measurement values in the male and female age groups was analyzed by Kruskal-Wallis Variance Analysis. SL and SAP values in males and PCH, TS and SM values in females were found to be statistically different between age groups (Table 2). To detect the values that caused the difference, pairwise comparisons were performed by the Mann-Whitney U test with Bonferroni adjustment (Table 3).

In males:

SL values of the 41–60 y group were significantly higher than those of the <26y and 26-40y groups ($p_{adjusted} < 0.0125$) (Table 3).

SAP values of the 41-60y group were significantly higher than those of the <26y group ($p_{adjusted} < 0.0125$) (Table 3).

Table 2. Sella measurement values in different age groups of the males and the females*.

	Males (n=122)					Females (n=63)				
	26> y (n=38)	26-40 y (n=32)	41-60 y (n=39)	>60 y (n=13)	P**	26> y (n=19)	26-40 y (n=19)	41-60 y (n=17)	>60 y (n=8)	P**
SL	9.30	9.20	10.70	9.80	0.002	8.80	8.90	9.30	9.55	0.953
PCH	8.65	9.05	9.80	8.90	0.309	7.90	9.50	10.60	8.35	0.007
TS	7.90	8.25	8.30	8.00	0.983	7.30	7.70	8.80	8.30	0.001
SA	4.20	3.20	3.60	3.70	0.512	3.20	3.30	4.10	3.60	0.407
SM	8.65	8.70	8.80	8.90	0.811	7.50	8.30	9.80	8.20	0.002
SP	3.90	3.80	4.30	3.90	0.401	3.40	3.40	4.85	4.10	0.213
SAP	10.40	10.70	11.30	10.80	0.043	10.40	11.60	11.50	11.80	0.146

*Values were given as median
**p value shows the results of Kruskal Wallis Variance Analysis
SL: Sella length, PCH: Posterior clinoid height, TS: Tuberculum sella, SA: Sella height anterior, SM: Sella middle height, SP: Sella height posterior, SAP: Sella anterior-posterior dimension.

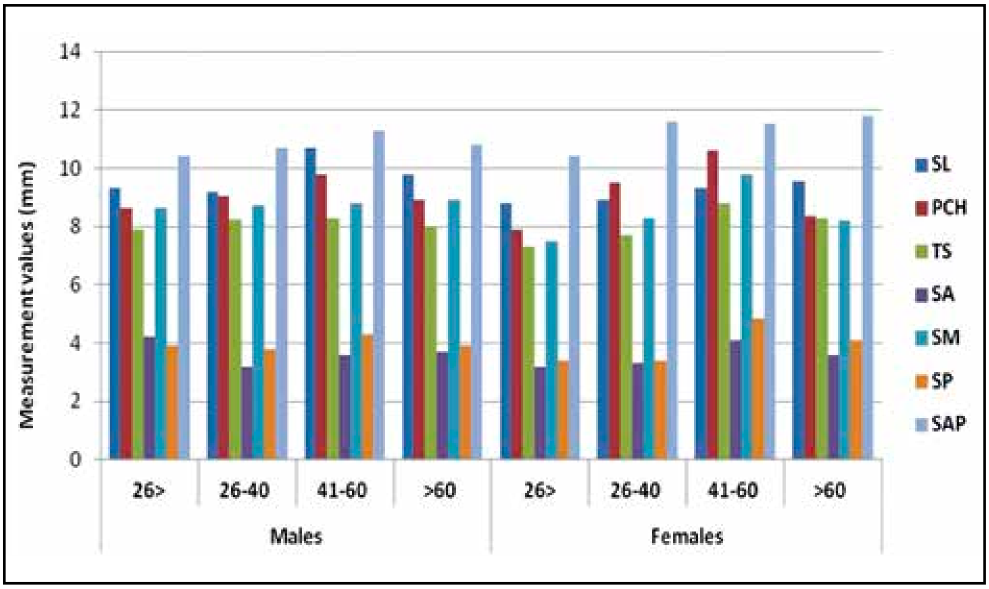

Figure 3. Sella measurement values in different age groups of the males and the females.

In females:

SM values of the 41-60y group were significantly higher than those of the <26y group ($p_{adjusted} < 0.0125$) (Table 3).

TS values of the 41–60y group were significantly higher than those of the <26y and 26-40 y groups ($p_{adjusted} < 0.0125$) (Table 3).

PCH values of the 41-60y and 26-40y groups were significantly higher than those of the <26y group ($p_{adjusted} < 0.0125$) (Table 3).

Sella types are shown in Table 4. In both males and females, mainly the circular type of sella was observed (64.8% and 74.6%, respectively). The flat type was the second most detected, and the oval-type sella was the least observed type in both males and females. There was no significant difference between the sella types of males and females ($p = 0.367$, $\chi 2 = 2.006$).

Sella measurement values in different sella types are

Table 3. Pairwise comparisons for different age groups*.

	26> vs 26-40 y		26> vs 41-60 y		26> vs >60 y		26-40 vs 41-60 y		26-40 vs >60 y		41-60 vs >60 y	
	z	$p_{adjusted}$	z	$p_{adjusted}$	z	$p_{adjusted}$	z	$p_{adjusted}$	z	$p_{adjusted}$	z	$p_{adjusted}$
Males												
SL	-0.896	0.370	-3.604	0.000	-1.795	0.073	-2.555	0.011	-0.827	0.408	-1.395	0.163
SAP	-0.938	0.348	-2.666	0.008	-1.395	0.163	-1.758	0.079	-0.552	0.581	-1.047	0.295
Females												
SM	-2.351	0.018	-3.646	0.000	-1.142	0.260	-1.776	0.076	-0.638	0.549	-2.041	0.043
TS	-1.213	0.234	-3.932	0.000	-1.835	0.066	-2.822	0.005	-0.984	0.333	-1.050	0.315
PCH	-2.542	0.010	-3.155	0.001	-0.691	0.515	-0.967	0.333	-1.037	0.307	-1.836	0.066

*$p_{adjusted}$ value shows the results of the Mann Whitney U test with Bonferroni ajustment; and padjusted <0.0125 considered as statistically significant
SL: Sella length, PCH: Posterior clinoid height, TS: Tuberculum sella, SM: Sella middle height, SAP: Sella anterior-posterior dimension.

shown in Table 5 and Figure 3. Except SP value, there was a statistically significant difference between the SL, PCH, TS, SA, SM and SAP values of the oval, flat and circular sella types (Kruskal-Wallis Variance Analysis test, $p < 0.05$). To detect the values that caused the difference, pairwise comparisons were performed by the Mann-Whitney U test with Bonferroni adjustment (Table 6).

The SL distance of the flat sella was significantly longer than those of the oval and circular types. In circular sella types, the SL distance was higher than that of the oval sellas ($p_{adjusted} < 0.0175$) (Table 6).

The SAP distance of the flat sella was significantly longer than those of the oval and circular types ($p_{adjusted} < 0.0175$) (Table 6).

PCH, TS, SA and SM measurements of the flat sella were significantly shorter than those of the oval and circular types ($p_{adjusted} < 0.0175$) (Table 6).

With respect to the PCH, TS, SA, SM and SAP values, there was no significant difference between oval- and circular-type sellas ($p_{adjusted} > 0.0175$) (Table 6).

Spearman's correlation rho efficient test results are shown in Table 7. In older patients, the SL, SM, TS, PCH and SAP values increased ($p < 0.05$) (Table 7). Increases in SL were positively related to increases in PCH, SP and SAP values ($p < 0.05$) (Table 7). The TS, PCH, SA, SP and SAP values increased together ($p < 0.05$) (Table 7).

Table 4. Sella types.

	Males (n=122)		Females (n=63)		P*
	n	%	n	%	
Oval	9	7.4	4	6.3	P=0.3670 χ2=2.006
Circular	79	64.8	47	74.6	
Flat	34	27.8	12	19.1	
Total	122	100.0	63	100.0	

*p value shows the results of Chi-square test

DISCUSSIONS

Sella turcica is a saddle-like bony formation on the upper surface of the body of the sphenoid bone. The anterior border of the sella turcica is represented by the tuberculum sellae, and the posterior border by the dorsum sellae[4]. In the current literature, the size of the sella turcica is reported to be between 4 and 12 mm vertically and between 5 and 16 mm for the anteroposterior dimension[6,8-10]. In the present study, the median sella length was 9.7 mm in males and 9.2 mm in females. Tuberculum sella height was 8.1 mm in males and 7.90 mm

Table 5. Sella measurement values in different sella types.

	Oval (n=13)			Circular (n=126)			Flat (n=46)			P*
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	
SL	80.77	70.70	40.61	90.41	90.30	10.51	100.93	110.25	10.51	0.000
PCH	100.55	100.10	40.92	90.49	90.35	20.16	70.83	70.85	20.10	0.000
TS	100.22	80.80	50.66	80.49	80.30	10.52	60.94	60.60	10.62	0.000
SA	50.41	40.80	30.14	30.98	30.60	10.43	20.98	20.70	00.88	0.003
SM	100.38	90.10	50.27	80.97	80.90	10.52	70.33	70.65	10.64	0.000
SP	40.97	40.10	20.51	40.01	30.90	10.27	30.80	30.70	10.24	0.417
SAP	110.09	100.20	50.03	100.80	100.70	10.92	110.69	110.55	10.44	0.002

*p value shows the results of Kruskal Wallis Variance Analysis Test
SL: Sella length, PCH: Posterior clinoid height, TS: Tuberculum sella, SA: Sella height anterior, SM: Sella middle height, SP: Sella height posterior, SAP: Sella anterior-posterior dimension.

Table 6. The results of Mann Whitney U test with Bonferroni adjustment.

	Oval-Circular		Oval-Flat		Circular-Flat	
	z	p	z	p	z	p
SL	-2.659	0.008	-3.962	0.000	-5.293	0.000
PCH	-0.235	0.814	-2.488	0.013	-3.995	0.000
TS	-0.416	0.677	-3.157	0.002	-5.279	0.000
SA	-2.055	0.040	-3.102	0.002	-2.440	0.015
SM	-0.365	0.715	-2.982	0.003	-5.257	0.000
SAP	-1.104	0.270	-2.581	0.010	-3.231	0.001

*p adjusted<0.0175 is considered as statistically significant.
SL: Sella length, PCH: Posterior clinoid height, TS: Tuberculum sella, SA: Sella height anterior, SM: Sella middle height, SAP: Sella anterior-posterior dimension.

in females. The posterior clinoid height was 9.0 mm in males and 9.2 mm in females. Our results were similar to the literature. There was no significant difference between the sella measurements of the males and females. In contrast to our study, Chauhan et al.[6] reported a highly significant difference between males and females in the sella turcica height posterior and sella width. The sella turcica height posterior was higher in males, and the sella width was larger in females.

When measurements were performed in different age groups, the SL and SAP values (in males) and the PCH, TS and SM values (in females) were found to be statistically different between age groups. In males, the SL and SAP values of the 41-60y group were greater than in the younger group; in females, SM, TS and PCH values of the 41-60y group were greater than in the younger group. Our results showed that the development of sella turcica continues through the age of 41 to 60 years. In the male group, growth was detected mainly in the anterior-posterior direction (sella length and sella anterior-posterior dimension). However, in females, growth was detected mainly in the vertical direction (sella middle height, tuberculum sella and posterior clinoid height).

Choi et al.[11] reported that the dimensional changes in the sella turcica had a significant positive linear trend to length, depth and diameter until 25 years of age. After 26 years of age, no significant increase was found in sella turcica dimensions. Unlike the study by Choi et al.[11], in our study we detected that the development of the sella continues until 41 to 60 years, with anteroposterior growth in males and vertical growth in females.

Silverman[10] studied 320 subjects ranging from one month to 18 years of age and reported that sella turcica was larger in males than in females, except during puberty, as this occurs about two years earlier and is more pronounced in females than in males. Elster et al. studied magnetic resonance imaging slides of 169 patients aged 1–30 years and reported that, during childhood, there was no difference between males and females, but dramatic changes took place during puberty with swelling of the gland[12].

The shape of the sella turcica can be round, oval, or flat. However, the most common types are round and oval[13]. In the present study, when detecting sella types in both males and females, the circular type of sella was observed most often (64.8% and 74.6%, respectively). The flat type was the second most detected type, and the oval-type sella was the least observed type in both males and females. SL and SAP distance of the flat sella was significantly longer, and PCH, TS, SA and SM values of the flat sella were significantly shorter than those of the oval and circular types.

Sella morphology and shape are important in specific conditions. In Trisomy 21, the genotype affects the structure of the anterior wall of the sella turcica, the modification varying from a mild depression in the lower aspect of the anterior wall to more severe cases where the anterior wall is entirely separated from the posterior wall[14]. For another example, in Meckel–Gruber syndrome, the morphology of the sella turcica is characterized by a wide base in the dorsum sellae with an irregularly shaped notochordal remnant[15,16]. In Turner syndrome, the sella turcica appears larger and more open cranially than normal, with or without a cleft in the bottom[3]. Abnormal sella morphology is more common in type 1 diabetic patients[17]. In orthodontics, the sella point, which is located at the center of the sella turcica, is one of the most commonly used landmarks in cephalometrics[4].

In our study, SL, SM, TS, PCH and SAP values increased in older patients. Chauhan et al.[6] also reported that when age was evaluated, some dimensions showed a negative correlation with age. Sella size of the older age group was, as a rule, larger than that of the younger age group. These results were similar to ours. Additionally, in our study, an increase in SL was positively related to an increase in PCH, SP and SAP values. TS, PCH,

Table 7. Spearman's correlation rho efficient test results.

Mean	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Std. Dev.
Gender (Code 1: Male, Code 2: Female)	r		0.006	-0.072	-0.015	-0.028	-0.010	-0.046	-0.024	0.091
	p		0.933	0.332	0.836	0.708	0.889	0.659	0.749	0.217
Age	r	0.006		0.226	0.189	0.186	0.204	-0.011	0.124	0.282
	p	0.933		0.002	0.010	0.011	0.005	0.919	0.100	0.000
SL	r	-0.072	0.226		0.134	0.072	0.165	0.158	0.311	0.608
	p	0.332	0.002		0.069	0.328	0.025	0.131	0.000	0.000
SM	r	-0.015	0.189	0.134		0.768	0.863	0.416	0.457	0.352
	p	0.836	0.010	0.069		0.000	0.000	0.000	0.000	0.000
TS	r	-0.028	0.186	0.072	0.768		0.449	0.549	0.306	0.207
	p	0.708	0.011	0.328	0.000		0.000	0.000	0.000	0.005
PCH	r	-0.010	0.204	0.165	0.863	0.449		0.250	0.474	0.349
	p	0.889	0.005	0.025	0.000	0.000		0.015	0.000	0.000
SA	r	-0.046	-0.011	0.158	0.416	0.549	0.250		0.354	0.236
	p	0.659	0.919	0.131	0.000	0.000	0.015		0.001	0.023
SP	r	-0.024	0.124	0.311	0.457	0.306	0.474	0.354		0.337
	p	0.749	0.100	0.000	0.000	0.000	0.000	0.001		0.000
SAP	r	0.091	0.282	0.608	0.352	0.207	0.349	0.236	0.337	
	p	0.217	0.000	0.000	0.000	0.005	0.000	0.023	0.000	

SL: Sella length, PCH: Posterior clinoid height, TS: Tuberculum sella, SA: Sella height anterior, SM: Sella middle height, SP: Sella height posterior, SAP: Sella anterior-posterior dimension.

SA, SP and SAP values increased together. Also similar to our results, the study by Axelsson et al.[18] revealed a significant difference between gender and the length of the sella. They reported that the anteroposterior diameter and depth of the sella are different in males and females[18]. Similar results were achieved in Indian, Iraqi and Nigerian studies reporting the difference between sella length in males and females[19-21].

With the advancement of age, there are significant differences in sella turcica measurements in cranial CTs, particularly from 20 to 40 years and 40 to 60 years of age. While the growth process in the pituitary stalk occurs in males, this "adult fossa growth" occurs in both sexes. Though sella size was similar in young males and females, it was observed that the height of the sella increased in females by age. In advanced ages, this change might be related to sexual dimorphism.

First, the process of gender differences for sella turcica have been revealed by Haas (1954)[22] and Mahmoud (1958)[23]. After that, Israel declared similar ideas with all these works[24]. The varying results may be related to gender differences in sample groups or the exclusion of older patients from the studies. To explain the sella size differences, three hypotheses have been proposed. The first hypothesis cites changes in the vascular plexus. The second involves changes in the skeletal structure. As changes occur in the skeleton, skull, ribs, thighs, hand, etc. with age, changes may also occur in the pituitary region in terms of the sellar fossa and the pituitary gland. Third, remodeling or resorptive processes occur in the periosteal and endosteal parts. Hormonal mechanisms may affect these processes. As a result, sella size changes according to the aging process and is different in males and females[24].

In pituitary tumor cases with increased sellar AP dimensions, while tumor resection was performed by endoscopic transphenoidal approach, it was observed that the rate of peroperative or postoperative CSF fistula was higher during tumor extraction. The reason for this condition was due to the higher rate of herniation of the diaphragma sella in patients with longer sellar AP dimensions compared to the patients with shorter AP dimensions[25,26].

The present study showed that, in males, the anterior-posterior dimension of the sella increased with age. The reason may be related to the decrease in the pars anterior of the pituitary gland, and the enlargement of the pars posterior of the pituitary gland. The effects of these changes by age and their hormonal results should also be investigated in larger populations. In females, the length of the sella increased with age. We concluded that it may be due to pituitary stalk elongation. In the future, the reasons for elongation and its hormonal effects should be investigated in more detail.

Our study might be more valuable with a higher number of subjects and this is a limitation of our study.

CONCLUSIONS

This work is an anatomical measurement study. However, our results will prove useful to pituitary surgeons by showing that sella height increases vertically towards the sphenoid sinus of females between 41 and 60 years. In males, this study presents the possibility of increased risk of complications by showing how the anterior posterior diameter increases with age. These results provide important information for pituitary surgeons before surgery.

Clinicians should be aware of the structural changes in the sellar fossa and pituitary gland by gender and by age. Arguably, the anatomical variations of the sella region should be known well, and morphological changes and differences should be evaluated to avoid delayed diagnosis of tumoral and other pathologies of the sella turcica.

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